

cold prevailed southward over Iowa, the temperature at Des Moines at 7 p. m. being 12° below zero. During the succeeding 12 hours the cold wave swept south-eastward to the Ohio River with resulting temperatures (as previously mentioned), the lowest in more than a decade at many points. At Chicago, Ill., the minimum of -16° equaled the low record made on January 7, 1912. The reaction from this cold wave was very marked, and over some areas, particularly in the northern Plains States, the 24-hour rises amounted to from 50° to 60°.

The next cold wave appeared on the 9th in Saskatchewan and Manitoba, coming apparently from the region east of Alaska. At the same time a well-developed disturbance was central near the Kansas-Colorado boundary. Accordingly, warnings for a moderate cold wave were issued for most of the upper and middle Mississippi Valley, the Central Plains and Wyoming. Although a considerable fall in temperature occurred over the areas in question, verification was not attained except over a limited area.

On the night of the 14th a new cold wave appeared over the Canadian Northwest. During the following 24 hours the cold overspread the district as far as the upper Mississippi and middle Missouri Valleys, and the remainder of the district by the morning of the 17th, zero weather prevailing southward as far as St. Louis, Mo. The warnings issued in connection with this cold wave were fully verified.

In rapid succession to the cold wave just referred to, conditions again became critical over portions of the Northwest, so that warnings were issued on the night of the 17th for western Nebraska, northwest Montana, and Wyoming. These were verified, but the extension of the warnings on the morning of the 18th over Minnesota and northwestern Iowa was not justified.

On the morning of the 19th the temperature in southern Missouri, southern Illinois, and Indiana was comparatively high, in connection with a trough of low pressure that overlay those areas. At the same time a marked high area with attendant low temperatures was present in the Northwest—conditions apparently favorable for a cold wave in the areas named. Accordingly, warnings were issued, and the cold wave occurred as forecast.

By the morning of the 22d the barometer was rising rapidly throughout the Canadian Northwest, and based largely upon this condition cold wave warnings were issued for most of the northern States of the district. Subsequent developments, however, were such that the cold waves that occurred were confined to northeastern Montana, North Dakota and Minnesota.

The final cold wave of the month began on the 24th, and it swept the entire district during the following two days. In most cases the general warnings that were issued were verified. Over a considerable area the 24-hour fall in temperature ranged from 35° to 40°.

The reaction from this last cold wave continued during the remainder of the month with the result that the mildness of the closing days had a marked effect on the final average temperature of the month, increasing it by several degrees. Otherwise the month would have been more nearly comparable with the cold January of 1918.

Warnings for Lake Michigan.—Stormy weather prevailed on Lake Michigan on several occasions during the month, and with one or two exceptions timely advices of impending conditions were issued. The first strong winds to occur were in connection with the reaction from the severe cold wave of the 5th. A low-pressure area moved southeastward from the Canadian Northwest on the 5th

and 6th, which, in connection with the great cold high area that overlay the South on the 6th, created a sharp gradient over Lake Michigan, with the result that strong winds and moderate gales occurred on that date. The advisory warning in this connection was issued on the morning of the 6th.

The next advisory for Lake Michigan was that on the 9th in connection with the storm that crossed the Great Lakes on the 10th. At some points on Lake Michigan moderate gales occurred. The advisory warning was continued on the 10th.

On the 16th a warning was issued in connection with the disturbance that preceded the cold wave of the 17th. The storm center passed eastward just south of Lake Michigan, and although the gradient was rather steep, no storm winds were reported from points on the Lake.

So far as pressure conditions were concerned, the reaction from the severe cold wave of the 21st-22d was quite similar to that which occurred on the 6th. Advisory warnings were issued on both the 21st and 22d, and strong southwest winds and moderate gales were general on Lake Michigan on those dates.

The last advisory warning for Lake Michigan was issued on the night of the 24th in connection with the cold wave that was about to overspread the Lake. At that time an elongated disturbance was advancing eastward across the Lake region with increasing strength. By the morning of the 25th the disturbance had become a storm of the first magnitude with its center over Georgian Bay, and a barometer reading of 29.24 inches at Parry Sound. At the same time the pressure was about 30.60 inches over the upper Missouri Valley. Press dispatches indicate that the 25th was one of the stormiest days in years in lower Michigan.

Stock interests were advised on the 9th, 15th, 22d, and 24th of expected weather conditions that might prove adverse.—*C. A. Donnel.*

NEW ORLEANS FORECAST DISTRICT.

Unseasonably cold weather prevailed throughout the district, with some intense cold waves. The first cold wave of the month occurred at El Paso, Tex., on the 3d, for which warning was issued on the 2d. Cold-wave warnings were issued on the evening of the 3d for Oklahoma, the northern portion of west Texas, and the northwest portion of east Texas, and extended on the morning of the 4th over Arkansas. Conditions were such on the 4th that special observations were called for and these showed a rapid movement of the high pressure and cold wave towards the south, and livestock, cold-wave and freezing-temperature warnings were extended to the West Gulf coast. The cold wave came with unusual rapidity, and in parts of the district was the coldest during the last five years. Much saving of property resulted from the warnings.

Another severe cold wave overspread the interior of the district on the 10th, for which warnings had been issued on the 9th. Warnings were issued on the 16th for a moderate cold wave which occurred over the northern portion of the district on the 17th. Warnings were issued on the 19th for a severe cold wave which overspread the greater portion of the district on the 20th and 21st, with temperature below freezing to the Gulf coast. No cold wave of any consequence occurred without warning. Storm warnings were displayed on parts of the Texas coast on the 4th, 19th, and 20th, all of which were verified. Storm warnings on the Louisiana coast were only partially verified but conditions were so

threatening that they were called for. Small-craft warnings were displayed on parts of the coast on the 2d, 4th, 9th, 10th, and 15th. No storms occurred without warning.

"Norther" warning was issued for Tampico, Mexico, on the afternoon of the 20th, and was justified.—*I. M. Cline.*

DENVER FORECAST DISTRICT.

Storms of considerable intensity which moved eastward from the southern Rocky Mountain Plateau on the 1st-2d, 8th-9th, and 14th-15th were attended by occasional snow in nearly all of the district except the extreme southwestern portion. The LOW of the 1st was followed by a cold wave in southern Colorado, northern New Mexico, northeastern Arizona, and southern Utah. A disturbance which appeared in western Canada on the 13th advanced slowly southward and was followed during the period from the 15th to the 17th by a HIGH from Alberta, attended by a cold wave that reached extreme southeastern New Mexico on the last-named date. Another LOW that was also followed by a cold wave on the eastern slope advanced southeastward from British Columbia during the 16th, 17th, and 18th, the cold wave extending to southeastern New Mexico by the morning of the 20th. During the last decade of the month, high pressures prevailed on the middle Rocky Mountain Plateau, with low pressures to the northward and eastward. These conditions were attended by generally fair weather in the district and by moderate temperatures on the eastern slope.

On the morning of the 1st, livestock warnings were issued for southwestern Colorado, northern New Mexico, northeastern Arizona, and southeastern Utah. At 2 p. m. of the same day, warnings of a moderate cold wave, based upon special observations, were issued for western Colorado, northern Arizona and Utah "to-night" and for north-central and north-western New Mexico "to-night and Wednesday." Warning of a moderate cold wave in northern New Mexico was repeated at 8 p. m.

Snow fell during the day of the 1st in western Colorado, northwestern New Mexico, northern Arizona, and eastern Utah and during the following night in western Colorado, north-central New Mexico and southern Utah, with the heaviest falls in extreme southwestern Colorado and northeastern Arizona. The cold-wave warnings were fully verified, except in northwestern Colorado and northern Utah.

At 8 p. m. of the 3d, warnings of a severe cold wave were issued for southeastern Colorado and eastern New Mexico, and warnings of a moderate cold wave were extended to extreme southeastern New Mexico on the morning of the 4th. The warning was verified in southeastern Colorado and that portion of New Mexico east of the mountains.

Warnings of a moderate cold wave in eastern Colorado "during the next 24 hours" were issued at 2 p. m. of the 15th and were repeated at 8 p. m. of the same date. The warnings were completely verified.

At 8 a. m. of the 16th, severe cold-wave warnings and livestock warnings were issued for eastern Colorado and northeastern New Mexico. Snow occurred during the same day in central and eastern Colorado and extended to extreme northeastern New Mexico during the night. The cold-wave warnings were verified in eastern Colorado and that portion of northeastern New Mexico east of the mountains.

A warning of a cold wave that failed of verification was issued for extreme southeastern New Mexico at 8 p. m. of the 16th. The failure was due to the fact that an expected rapid increase in pressure did not occur in the southeastern portion of the forecast district.

Warnings of a severe cold wave "to-night and Saturday" and livestock warnings for eastern Colorado, with warnings of a moderate cold wave for extreme northeastern New Mexico, were issued at 8 a. m. of the 18th. Severe cold-wave warnings for eastern and central Colorado, with warnings of a moderate cold wave for extreme northeastern New Mexico, were repeated on the evening of the same date. Light snow fell in eastern Colorado during the following night and the next day, with a fall in temperature throughout all of the territory specified that was amply sufficient to justify the forecasts.

On the morning of the 19th, warnings were distributed of a severe cold wave in southeastern Colorado and of a moderate cold wave in extreme eastern New Mexico. The warning was completely verified.

Local cold waves for which no warning was issued occurred at Durango on the morning of the 10th and at Flagstaff on the morning of the 17th.

Forecasts of freezing temperatures were issued for south-central and southeastern Arizona on the 2d, 4th, and 19th; for south-central Arizona on the 13th, 15th, and 17th, and for southeastern Arizona on the 9th. The warnings were generally verified.

Frost warnings for Arizona were issued as follows: 1st, 3d, and 9th, heavy in south portion; 2d, 4th, 17th, and 19th, heavy in extreme southwestern portion; 5th and 11th, frost south-central portion; 12th, heavy in south-central portion; 13th frost extreme southwestern portion; 14th and 16th, heavy frost in south-central and southwest portion; 15th, heavy in southwest portion; 18th, frost in south-central portion; 23d, 24th, 25th, and 26th, frost in southwestern portion. The warnings were verified as a rule by the occurrence of frost or temperatures at which frost might be expected.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT.

The controlling factors of the weather over the Pacific slope during January, 1924, were the persistence of an area of high pressure over the intermountain region while the pressure remained comparatively low over British Columbia and Alberta. This pressure distribution favored the passage inland of storms from the north Pacific at a high latitude, and is the typical condition to cause dry weather over the central and southern portions of the Pacific coast.

Warnings of severe frosts in California were issued 17 times, and while some damage was done to citrus fruit and vegetables, no damaging frost occurred without warnings.

Storm warnings were ordered as follows: Southeast warnings from Tatoosh to Point Reyes on the 2d; south-east warnings from Eureka to Point Reyes on the 25th; southwest warnings at Washington coast stations on the 26th; southwest warnings at all stations from Point Reyes north on the 27th; southwest warnings Washington and Oregon stations on the 29th; warnings changed to southeast at Washington and Oregon stations on the 30th; southeast warnings continued at Washington and Oregon stations on the 31st. The warnings were mostly verified and from gales reported a short distance at sea all are believed to have been justified.—*G. H. Willson.*